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AUTHOR Finger, Glenn; Rotolo, Carolyn
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ABSTRACT

In 1998 the Charleville School of Distance Education (SDE) in Queensland, Australia, began using telephone teaching to replace high frequency radio as its means of communicating with rural and remote students. A study investigated the extent to which telephone teaching has contributed to the development of a constructivist teaching and learning environment. A literature review describes aspects of four generations of distance education and discusses previous studies of telephone teaching, the teaching strategies used in telephone teaching, and the benefits of the interactive teleconferencing environment. Results of the present study indicate that the 13 teachers at Charleville SDE were using teaching strategies and facilitating interactions that reflect the major tenets of constructivist philosophy. Teachers reported that their most utilized strategies were catering to the individual needs of students, making use of students' prior knowledge, and providing students with opportunities for reflection. Overall, teacher ratings of teaching strategies and learning activities used suggest that the SDE environment was strongly supportive of a constructivist teaching and learning paradigm. Teacher responses to the Community of Learners Scale indicate that telephone teaching supported a community of learners and fostered teacher-student and peer interaction. Details are provided on the incidence of specific teaching strategies and learning activities. (Contains 38 references.) (SV)

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# Telephone Teaching: Towards Constructivist Teaching for Rural and Remote Students

Dr Glenn Finger and Ms Carolyn Rotolo

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**Dr Glenn Finger**
School of Education and Professional Studies,
Gold Coast Campus Griffith University,
PMB 50 Gold Coast Mail Centre, Queensland, Australia. 9726.
Phone 07 55528618
Email: g.finger@mailbox.gu.edu.au

**Carolyn Rotolo**
School of Education and Professional Studies,
Gold Coast Campus Griffith University,
PMB 50 Gold Coast Mail Centre, Queensland, Australia. 9726.

Paper presented at the Annual Conference of the Australian Association for Research in Education,
Fremantle, December 2001

## Abstract:

While many school systems are exploring the potential of new technologies, the reality for many rural and remote students in Australia is that they still rely upon High Frequency (HF) Radio as their main form of communication with teachers. After using HF Radio for several decades, the Charleville School of Distance Education (CSDE) in Queensland has commenced using telephone teaching with the aim of improving the delivery of education for its rural and remote students. This study investigated the central research question – has the replacement of HF Radio with the telephone for teaching contributed to the development of a constructivist teaching and learning environment? The theoretical framework for this study was based on Garrison's (1993) theory of transactional constructivism. Findings strongly indicated that the telephone teaching and learning environment at the CSDE was substantially constructivist in nature. The findings reported have implications for initiatives aimed at improving the education of rural and remote students. Furthermore, the study suggests that further research needs to be directed towards investigating a broad range of new technologies which build upon the platform of telephone teaching to enhance the delivery of educational programs to rural and remote students.

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## Introduction

"We're not gonna sit in silence…" The lyrics to the Johnny Farnham song were heard through the headphones clearly as 'Bushy' and his youngest brother 'Chook' listened in to the start of Bushy's Year 10



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mathematics lesson. Bushy and Chook weren't the stereotypical vision of students. There were no polished shoes, neat uniforms, bells being rung, and no carpeted classroom floor. Bushy had come in from the paddock and Chook followed his older brother into their schoolroom, a mix of concrete floor and dirt. The roof was supported by tree trunks and the ventilation was adjusted by branches of different lengths. The teacher, after checking which students were present, said that he'd decided to start the lesson with that particular song as a reminder of how distance education helped to ensure that communication occurred.

While universities and teaching institutions world-wide go 'on-line' in this Information Age, there exists cohorts of many young people in rural and remote regions of Australia for whom their main means of communication is High Frequency (HF) Radio. For the families we visited on properties in remote areas of South West Queensland, serviced by the Charleville School of Distance Education (SDE), the mail is delivered once a week. For some families this means a Thursday delivery and with their mail they receive their only newspaper which is the previous Saturday's edition of *The Courier-Mail*. This level of communication infrastructure is in marked contrast to that available to other young Australians who can readily connect to the rest of the world.

The catalyst for the focus of this research was a study conducted by Hobbs, Finger and Torrisi-Steele (2000) evaluated the benefits of telephones over HF Radio for on-air lessons at the Charleville SDE. One of the major findings of that study was that the replacement of HF Radio with the telephone for on-air lessons had resulted in more effective teaching and learning occurring. The significance of that finding for the future of distance education at the Charleville SDE, and how best distance learners may be taught, demanded greater attention.

## The Research Problem

In 1997, a limited trial of the telephone replacing HF Radio for on-air lessons was conducted at the Charleville SDE (Hobbs, 1998). This evaluation resulted in a whole school telephone pilot trial in 1999 extending into 2000 (Hobbs et al., 2000). That evaluation report identified a greater range of teaching strategies (including learning activities) were able to be utilised as a result of the telephone, as well as an increase in interaction occurring between students and teachers, and among students themselves. This paper reports findings which further explored these characteristics of the telephone teaching environment from a constructivist perspective. The central research of this subsequent study of the Charleville SDE telephone teaching was - Has the replacement of HF Radio with the telephone for teaching on-air lessons contributed to the development of a constructivist teaching and learning environment at the Charleville SDE?

## Significance of this Study

The impact of the new and emerging technologies on the delivery of education to students is currently the focus of much research. Until the whole school telephone teaching pilot trial in 1998, the students at the Charleville SDE received lessons via HF Radio which had the following major limitations:

- teachers and students battling static and fade-outs;
- lessons cancelled due to stormy weather;
- at times, students unable to hear teachers and vice versa;
- students unable to hear other students;
- at times, teachers having to repeat instructions;
- at times, teachers having to guess what children say; and
- teachers only being able to employ a very limited range of teaching strategies.

However, a trial conducted at the Charleville SDE which saw the replacement of HF Radio with the telephone for on-air lessons realised positive changes to the nature of the teaching and learning environment, reported by Hobbs et al. (2000) in their evaluation report. Our study aimed to add significantly to their investigation by examining the characteristics of the telephone teaching environment in order to ascertain whether these characteristics are reflective of a constructivist philosophy as defined in the literature. In particular, this study examined the telephone teaching environment at the Charleville SDE after telephone teaching had been implemented for almost a year, which had enabled teachers a more sustained period of implementation when compared with the Hobbs et al. evaluation.

## The Research Design

This study used a mixed-method design in which a qualitative methodology was used in conjunction with a quantitative one. To investigate the research question, two assessment instruments were used. The first instrument was modelled on an existing instrument by Greer, Hudson and Wiersma (1999) aimed at assessing constructivist teaching practices in the educational setting. This instrument was modified to align with the context of this study. The other instrument was constructed based on the constructivist teaching strategies identified in the literature.

Constructivism, for this study, refers to a learning environment that is as rich as possible in order to encourage the learner to discover and inquire through experience and opportunities (Barnes & Reid, 1993). Roblyer and Edwards (2000) state that constructivist goals focus on students' ability to solve real-life problems and practical problems, and its methods call for students to construct knowledge themselves rather than to simply receive it from teachers. Teaching methods based primarily on objectivist learning theory are associated with more traditional, teacher-directed forms of instruction (Roblyer & Edwards,

2000). Within this paradigm, the teacher has control of the presentation and evaluation of learning material (McInerney & McInerney, 1998).

Thirteen teachers from the Charleville SDE were involved in this study. Of the 13 teachers, ten were female and three were male. At the time of this study, all thirteen teachers were involved in on-air telephone teaching lessons.

### The Charleville SDE Whole School Telephone Teaching Pilot

The Charleville SDE is approximately 750 km west of Brisbane, the capital city of the state of Queensland in Australia, and is the largest town in the south-west of the outback region of Queensland. The Charleville SDE (formerly the Charleville School of the Air) was established in 1966, and today provides distance education services to over 300 rural and remote students from Preschool to Year 10 living throughout Southern Queensland (Charleville SDE, 2000).
Delivery of curriculum programs is provided through print materials, on-air lessons, and field services that provide face-to-face contact with students. Traditionally, the on-air lessons have been provided using HF Radio.

The Charleville SDE experimented with the telephone as an alternative medium to HF radio for teaching in a limited trial in 1997. The trial was extended in 1998, and an independent evaluation concluded that "on-air lessons conducted by telephone carry educational benefits over lessons conducted by HF radio" (Hobbs, 1998, p. 8). In 1999, a twelve-month whole-school telephone teaching pilot began at Charleville to explore further the costs and educational advantages of telephone teaching. An independent evaluation concluded that "telephone teaching not only has the capacity to meet the educational needs of the school but also provides much greater effectiveness in learning and teaching than HF radio" (Hobbs et al., 2000, p. iv). Specific characteristics of this effective teaching and learning environment identified in the report were an increase in the range of teaching strategies able to be utilised as a result of the telephone, and an increase in interaction occurring between students and teachers, and among students themselves, as a result of the telephone. These two characteristics of the telephone teaching and learning environment were chosen to explore further in this study for a number of reasons, which are outlined in the following section.

As stated, this study chose to focus on two elements of the telephone teaching and learning environment, that is, teaching strategies and interaction. Justification for this is that firstly, both elements were identified by Hobbs et al. (2000) as among two of the most significant changes to the teaching and learning environment since the introduction of the telephone. Secondly, a thorough search of the literature relevant to telephone teaching repeatedly identified the presence of these two elements. Thirdly, as will

become more apparent later in the literature review on constructivism, an analysis of these two elements provide support to the existence or absence of constructivist teaching practices in an education setting. Lastly, the data gathering instrument used in this study, which is an adaptation of an instrument developed by Greer, Hudson and Wiersma (1999) for assessing constructivist teaching practices in the educational setting, includes these two components. Thus, further investigation of these elements is clearly warranted.

## Technology in Distance Education: Four Generations of Technological Innovations in Distance Education

The evolution of distance education is characterised by new teaching approaches made possible by the advent of new communications technology. These sophisticated communications technologies allow for the creation of synchronous and asynchronous collaborative communities of inquiry (Garrison, 2000). Garrison states that technology and distance education are inextricably linked, and that all forms of distance education are mediated by technology (Garrison, 1985). "The essential nature of mediated communication to distance education emphasises the need to understand the impact that new technologies have had on distance education delivery modes" (Garrison, p. 235). The main purpose of this section is to explore distance education in terms of the four generations of technological innovation purported in the literature – correspondence, telecommunications, computers, and the Internet – with the telephone situated in the second generation of technologies in distance education. In the current context, the term 'generation' is used to describe the development of distance education technology.

### First Generation Distance Education

Also referred to as 'Correspondence Education', First Generation Distance Education was realised by combining the printed word and the postal system as a medium of two-way communication. Correspondence education represented a significant shift from face-to-face interaction in the delivery of traditional instruction (Garrison, 1985). Although providing educational opportunities to vast numbers of people by providing the freedom to choose when and where to study, on the down-side, two-way communication between teacher and student is slow, sparse, and mostly restricted to the periods when the learners submit scheduled assignments (Nipper, 1989).

### Second Generation Distance Education

Developed in the late 1960s (Nipper, 1989), Second Generation Distance Education, also referred to as 'Telecommunications Generation' or 'Multi-Media Distance Education', goes beyond just text and postal correspondence characteristic of First Generation Distance Education (Kirkwood, 1998). The term 'telecommunications' refers to the "use of wire, radio, optical or other electromagnetic channels to transmit or receive signals for voice, video, and data communications" (Olgren & Parker, 1983, p. 330 cited in

Garrison, 1985, p. 236). Put simply, telecommunications refers to the electronic transmission of communications over a distance (Garrison, 1985). In Second Generation Distance Education, the use of telecommunications includes the telephone and teleconferencing (audio, video and computer), and can involve the integration of print with these media.

### Third Generation Distance Education

Dramatic new possibilities are open to distance education through the capabilities of computer assisted learning. Kirkwood (1998) states that in Third Generation Distance Education, there is a greater emphasis on the use of communication technologies to facilitate dialogue between participants in the educational process. Commencing in the early 1980s, third generation benefitted from the emergence of communication networks and satellite technologies facilitating the delivery of analogue and digital content to computer workstations (Passerini & Granger, 2000). These technologies also enable new forms of real time interaction with two-way videoconferencing, or one-way video and two-way audio communication.

### Fourth Generation Distance Education

Passerini and Granger (2000) identify a new generation of distance education brought about as a direct result of the Internet: Fourth Generation Distance Education. They state that "Internet technology empowers the joint exploration of the delivery mechanisms of previous generations, adding stronger collaborative learning elements" (Passerini & Granger, 2000, p.3). In providing a provocative view, Passerini and Granger argue that it is only with the use of the Internet, and the World Wide Web, that distance education moves away from an objectivist approach to education to a constructivist environment. They suggest a hybrid design model that merges step-by-step and objectivist methodologies with flexible design and constructivist strategies, resulting in a richer learning environment.

Telephone teaching makes it possible to "electronically assemble a class of students who may not only interact with the teacher but with each other" (Garrison, 1990, p. 15). Garrison states that telephone teaching makes distance learning no longer an independent and isolated form of learning, and approaches the interactive level of an on-site educational experience. Further to this, Garrison (1985) posits that the use of the telephone by a teacher for instructional purposes is perhaps the most personalised use of telecommunications in distance education. With the introduction of telephone teaching, the slow interaction of correspondence study was dramatically overcome. However, it did not necessarily mean that the carefully prepared print materials would be redundant (Garrison). As is the case at the Charleville SDE, new media in the form of the telephone, is combined with older media, such as print materials, to provide a greater range of choice for the design of effective distance education delivery systems.

**Previous Studies of Telephone Teaching**

Although previous research has explored the extent to which computer technologies can be used in ways consistent with a student-centred or constructivist philosophy (Barnes & Reid, 1993; Jonassen, Davidson, Collins, Campbell & Haag, 1995; Passerini & Granger, 2000; Roblyer & Edwards, 2000), to date, no study has investigated specific elements of the telephone teaching and learning environment from a constructivist perspective. In this respect, this study is significant as there exists a gap in the literature in regard to our research question. The previous studies utilised in the following section of the literature review which examine the use of the telephone for on-air lessons, provide valuable insight into the complex nature of the telephone teaching and learning environment.

A study by Hobbs et al. (2000) which investigated the replacement of HF radio with telephone for on-air lessons at the Charleville SDE, found many benefits of the telephone over HF radio. These included increased motivation, greater understanding of the learner, greater participation, enhanced critical thinking skills, greater discussion (between both teacher and student and the students themselves), improved attention, improved enjoyment, greater spontaneity, a greater range of teaching strategies being utilised, including debates, peer tutoring and group work. Whether or not these elements were constructivist in nature was not the purpose of Hobbs et al.'s study, however it is apparent, from the review of the literature on constructivism, that their data does support some of the central tenets of a constructivist philosophy.

Similarly, Riethmuller (1999) in reviewing the effectiveness of the telephone compared to HF radio for on-air lessons during the 1997 - 1998 limited telephone trials at the Charleville SDE, (a trial which commenced prior to the whole school telephone teaching pilot) found that "outstanding improvements to the quality and effectiveness of teaching and learning were evident" with the telephone compared to HF radio (p. 1). One of the benefits of the telephone cited by Riethmuller, and one which reflects a major tenet of constructivism as defined earlier in this literature review, was the evidence of "enhanced active construction of meaning" occurring by the students (p. 2). The telephone enabled the teacher to talk through and model learning steps with students, and then implement purposeful activities, which gave students the opportunity to demonstrate their learning during whole class and small group discussions, and problem solving.

Conrad and Nordstrom (1997) cite similar benefits of the telephone environment, including increased interaction, discussion and socialisation. Successful telephone teaching strategies include learner presentations, role play and guest-expert conferencing. DuGas (1987, cited in Wilkin, 1989, p. 305) found in her study that such strategies as debates and structured small group discussion sessions were able to be successfully implemented with the telephone. Similar findings are presented by Schmidt, Sullivan and

Hardy (1994) in their study of teaching migrant students algebra by telephone. They found that the telephone enabled the students an increased ability to communicate their ideas to other students, and to the teacher, and gave them the opportunity to respond to and ask questions of the instructor at any given moment. The success of telephone teaching was realised in the "high class grade averages" (p. 51).

Another benefit of the telephone for teaching is that it encourages reflection (Thompson, 1996). This is significant in the current study where reflection is cited as one of the elements characteristic of a constructivist philosophy, referred to earlier in this chapter. Although authors such as Laurillard (1993) do not include the telephone as a medium that supports reflection, others argue that reflection within a telephone teaching lesson is possible. For example, Thompson states that there is much unrevealed response during telephone teaching lessons that does suggest reflection, and that the spoken interaction itself, is the product of reflection.

While many benefits of the telephone for students and teachers are cited in the literature, Moore (1989) suggests that a benefit often overlooked is that of learner-learner interaction, stating that interaction among students is instrumental to learning. This is reiterated by Jonassen et al. (1995), who believe that the most valuable activity in the educational setting of any kind is "the opportunity for students to work and interact together and to build and become part of a community of scholars and practitioners" (p.7). Telephone teaching, because of its interactive nature, encourages this collaboration (Thach & Murphy, 1994). This is significant in the current study because of the emphasis in a constructivist teaching and learning environment on collaborative group work (Roblyer & Edwards, 2000). Interaction in the telephone teaching environment is the focus of the following discussion.

Much has been written about the effectiveness of telephone teaching in fostering interaction in distance education (Robson, 1996; Conrad & Nordstrom, 1997; Wilkin, 1989; Oliver & McLoughlin, 1997; Hobbs et al., 2000; Potter, 1983; Dymock & Hobson, 1998; Cookson and Chang, 1995; Hardy & Olcott, 1995; Anderson & Garrison, 1995). Of relevance to the current research is a study by Anderson and Garrison (1995) which sought to provide an understanding of the importance of interaction within a telephone teaching environment. Their study used a mixed-method design in which a quantitative methodology (a mail survey) was used in conjunction with qualitative methodologies (teleconferencing observations, semi-structured interviews, and a focus group). During investigation, two different models of telephone teaching practice became apparent. The two models were labelled the 'Community of Learners (COL)' model and the 'Independent Learning Support (ILS)' model. The COL model emphasised developing, extracting, and refining existing knowledge from the group, rather than on the teacher's transmission of knowledge to the students. It included learning activities such as structured discussion, student

presentations, debates and guest speakers designed to bring out and develop existing skills and knowledge from within the group. In contrast, the ILS model viewed the telephone teaching as an enhancement or adjunct to the learning package, which provided all activities, resources, and information necessary to successfully complete the course.

Results revealed that the COL students perceived the telephone teaching technology as supporting the development of a community of inquiry. Within this paradigm, the teacher was free to adopt many of the teaching strategies and activities used in face-to-face classroom teaching, and used class discussions, student presentations and facilitated more experimental activities such as on-line debates, guest audio speakers, or panel discussions. "The primary role of the teacher was to assist in the creation of knowledge through facilitation of interaction and critical discourse" (Anderson & Garrison, 1995, p. 41).

## Findings

The results obtained in this study appear to support the underlying principles of Garrison's (1993a) theory of transactional constructivism, and lend support to Hardy and Olcott's (1995) views of the goals of telephone teaching. That is, "to produce high-quality interaction, facilitate student autonomy and interdependence in the learning process, and foster a commitment by faculty to a rich learning experience" (p. 53). This study reported that the teachers at the Charleville SDE are utilising teaching strategies and facilitating interactions which reflect the major tenets of a constructivist teaching and learning philosophy.

## Teaching Strategies

Overall, the results obtained showed that the teachers were utilising teaching strategies and learning activities which reflected the major tenets of a constructivist teaching and learning philosophy. Table 1 presents the findings in relation to the responses gained from teachers using the Teaching Strategies/Learning Activities Scale. As displayed in Table 1, the most utilised strategies were those relating to the teachers' ability to cater to the individual needs of students (mean = 4.69), and to make use of students' background knowledge (mean = 4.54). These results support Garrison's (1995) belief that in a constructivist environment, teachers need to recognise the dynamic nature of learning and the need for flexibility during the implementation or learning phase. Similarly, Winn (1990) posits that the challenge in a constructivist environment is to "monitor and adapt to unpredicted changes in student behavior and thinking as instruction proceeds" (p. 64). According to these results, it would appear that the sustained two-way communication provided by the telephone has enabled this challenge to be met by the teachers at the Charleville SDE.

The finding that the teachers were utilising students' prior knowledge supports Brown, Collins & Duguid's (1989) belief that "probably the most important issue in designing constructivist environments is

authenticity, the extent to which the environment faithfully reflects the ordinary practices of the culture" (p. 21). The results also lend support to what Anderson and Garrison (1995) found in their study to be a successful teleconference. That is, that the success of the teleconferences were, in part, "dependent on the teachers' ability to provide learning activities appropriate to students' needs" (p. 41).

The strong result obtained in regard to the teachers' beliefs that they were providing students with opportunities for reflection, both on their own ideas, and on the ideas of others significantly supports a major tenet of Garrison's theory of transactional constructivism, whereby "meaningful and worthwhile knowledge is constructed and validated through both individual reflection and social discourse" (1995, p. 138). Although there is the contentious issue of whether or not the telephone is a medium which can support reflection (Laurillard, 1993), the finding in this study that, according to the teachers, student self-reflection was occurring, provides further evidence that the telephone teaching and learning environment at the Charleville SDE is a constructivist one.

**Table 1: Teaching Strategies/Learning Activities Scale**

| Teaching Strategies and Learning Activities | Mean* |
|---|---|
| Teacher accommodates students' needs and interests by modifying the lesson when the opportunity occurs. | 4.69 |
| Teacher consistently and systematically attempts to activate and/or make use of students' background knowledge. | 4.54 |
| Teacher intentionally provides students with opportunities to reflect on their own and others' ideas. | 4.46 |
| Activities are readily adaptable to accommodate individual students' interests, needs and abilities. | 4.31 |
| Teacher frequently provides students with opportunities for scaffolding from teacher or other students. | 4.08 |
| Teacher questioning is mostly to help students think through an issue for themselves. | 4.08 |
| Teacher frequently uses strategies that encourage students to become more independent learners, where independence refers to the student assuming | 4.00 |
| responsibility for constructing meaning in a collaborative or interactive setting. | |
| Activities nearly always require students to relate ideas, concepts and knowledge. | 4.00 |
| Learning activities usually provide opportunities for students to reflect on their own and others' ideas. | 4.00 |
| When students encounter contradictions and errors, they seek resolution. | 4.00 |
| Teacher routinely has consistent awareness of students' understandings. | 3.92 |
| Opportunities for both confirming and disconfirming solutions are frequently provided. | 3.77 |
| Use of questions is intended to reveal students' developing knowledge structures. | 3.77 |
| Students frequently have input into the topics studied. | 3.69 |
| Activities almost always require students to explain and elaborate the results of their learning to other students. | 3.62 |
| Most activities cannot be solved through the routine application of previously learned knowledge. They require the use of knowledge and skills in new ways. | 3.33 |
| Opportunities for students to question, and/or seek information are the rule rather than the exception. | 3.27 |
| Activities require students to be self-directed. | 3.15 |
| Teacher relies mainly on discussion-generating questions, rarely using literal level recall and known-answer questions. | 3.08 |
| Teacher's primary role is to facilitate critical student inquiry, not to provide knowledge, skills, and answers. | 3.08 |

***Scale: 1 to 5 where 1 = not at all and 5 = very high**

On the Teaching Strategies/Learning Activities Scale, an average mean of 3.64 out of a possible 5 was obtained. This suggests that the telephone teaching and learning environment at the Charleville SDE, as

measured by teachers' perceptions of the teaching strategies and learning activities utilised, while not strongly constructivist in nature, was found to be substantially supportive of a constructivist teaching and learning paradigm.

### Interaction

Teachers were asked to indicate the extent to which they believed that the telephone teaching and learning environment was one which supported a community of learners and fostered interaction. Overall, the results obtained showed that the teachers supported the development of a community of learners through both teacher-student, and student-student interaction. Table 2 below presents the findings in relation to the Community of Learners Scale.

**Table 2: Community of Learners Scale**

| Community of Learners Scale | Mean* |
|---|---|
| Both teacher and students initiate and answer questions. | 4.31 |
| Students are intellectually active. | 4.23 |
| On-air discussions frequently provide opportunities for students to explain and elaborate their assumptions, points of view, and reasonings. | 4.15 |
| Students learn predominantly through interaction with others, including the teacher. | 4.08 |
| The control of the on-air discussion/conversation is shared between teacher and students. Participation is widespread. | 4.00 |
| Interaction to support the challenging and clarifying of ideas happens frequently. | 3.75 |
| Opportunities to work collaboratively are frequent. | 3.62 |
| Students frequently work together. | 3.62 |
| Opportunities for students to think aloud and receive feedback from peers are more the rule than the exception. | 3.38 |
| Climate of the telephone teaching environment is primarily challenging. | 2.92 |

***Scale: 1 to 5 where 1 = not at all and 5 = very high**

As indicated earlier in this paper, one of the many benefits of the telephone for teaching is a significant increase in interaction (Hardy & Olcott, 1995), and this has also been emphasised by Anderson and Garrison (1995), in that the "defining characteristic of audioteleconference-enhanced distance education is a substantial increase in human interaction" (p.29). This increase in interaction was repeatedly evident in the comments offered by the teachers, for example:

- "Students can interact and hear each other's ideas, responses (and help each other) and for music, students can sing and play together! (Peer tutoring with students following the lead of stronger singers)" (Charleville teacher, 2000).

In addition, the results in Table 2 show that high means were obtained on items relating to interaction. This is a significant result given that Dymock and Hobson (1998) identify interaction as an important component of effective learning. This notion is supported by Garrison and Shale (1990 cited in Garrison, 1993a), who state that the increased two-way communication and interaction brought about as a result of telecommunication technologies, such as the telephone, is likely to have the most significant impact upon the effectiveness of learning at a distance. Furthermore, Garrison (1993a) argues that "without sustained interaction, the learner has few opportunities to develop deep understanding and is not encouraged to do more than assimilate information" (p. 205).

Results obtained on the Community of Learners Scale also indicated that the telephone teaching environment at the Charleville SDE reflected some of the major characteristics of Anderson and Garrison's (1995) 'Community of Learners' model. The 'Community of Learners' model is a constructivist model of telephone teaching practice which emphasises developing, extracting, and refining existing knowledge from the group, rather than on the teacher's transmission of knowledge to the students. Among the major characteristics of Anderson and Garrison's model, which were found in the results obtained in this study, were the use of learning activities (for example, structured discussions) designed to bring out and develop existing skills and knowledge from within the group by encouraging students to explain and elaborate their assumptions, points of view, and reasonings through frequent interaction. Other similarities to Anderson and Garrison's model was an emphasis on developing a stable, 'virtual' classroom milieu in which students and teachers come to know each other through frequent audio interaction. Hence, further evidence of constructivist teaching practices occurring at the Charleville SDE is provided.

Although the results in Table 2 showed that student-student interaction was occurring, the results also showed that opportunities for collaborative group work were not frequent. Similarly, as is discussed in the following section, the teaching strategies of 'collaborative group work' and 'group investigations' were found to be used only occasionally by the teachers. This may suggest that although the students were being provided with opportunities to work together, and were encouraged to interact with each other while on-air, opportunities for the students to engage in truly collaborative learning communities, in which students participated as members of a 'critical community of learners' (Anderson & Garrison), were generally not occurring. This is an important finding, given Garrison's (1995) argument that the probability of constructing educationally worthwhile knowledge is greatly enhanced within a collaborative environment.

## Relative Importance and Frequency of Use of Constructivist Teaching Strategies at the Charleville SDE

Teachers were asked to indicate both the extent to which they felt the listed teaching strategies were important, and how often they actually utilised the strategies when telephone teaching. A discrepancy analysis was undertaken and is presented in Figure 1 on the following page.

As displayed in Figure 1, it can be seen that all of the teaching strategies are situated within Quadrants I and II, with the majority of strategies situated within Quadrant II. This is a significant result, and suggests that the teachers at the Charleville SDE are valuing and utilising teaching strategies which are constructivist in nature. The following analysis investigates those strategies situated within Quadrant II of 1, that is, strategies that were both valued and utilised by the teachers.

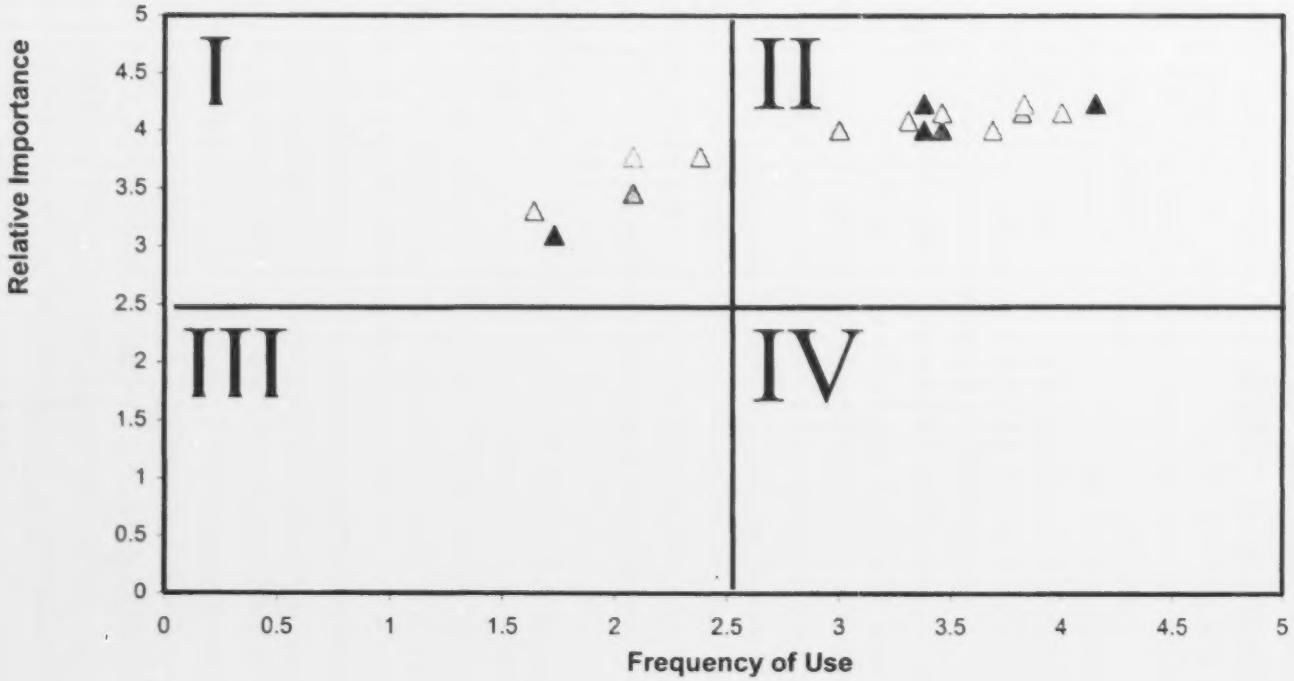
## Teaching Strategies situated within Quadrant II

### Student-Student Interaction

As displayed in Figure 1, results showed that 'encouraging student-student interaction' received a mean of 4.15 for relative importance, and a mean of 3.82 for frequency of use. Additionally, in Questionnaire One, the item on the Community of Learners scale which stated, 'Students learn predominantly through interaction with others, including the teachers', a mean of 4.08 was obtained. These results showed that the teachers at the Charleville SDE were encouraging student-student interaction, and lends strong support to Jonassen et al.'s (1995) opinion that "the most valuable activity in a classroom of any kind is the opportunity for students to work and interact together and to build and become part of a community of scholars and practitioners" (p. 7). Although, as stated by Moore (1989), student-student interaction is often an overlooked benefit of the telephone for teaching, based on the findings from this study, it could be assumed that this is not the case at the Charleville SDE.

Interestingly, apart from the finding that collaborative group work/pairs work was not frequently utilised by the Charleville teachers, all other results disputed the findings of previous studies, in which it was found that in the telephone teaching environment:

- student questioning and student/student exchanges were atypical (Thompson, 1996);
- low levels of learner control and autonomy were observed (Oliver & McLoughlin, 1997); and
- Robson's (1996) finding that interaction between students was generally not occurring.




| | | | | |
|---|---|---|---|---|
| △Collaborative group work | ▲Problem-centred learning | ▲Open-ended questions | △Information-seeking questions | △Student-led discussions |
| ▲Student presentations | △Peer tutoring | ▲Student-initiated questioning | △Student self-reflection | △Student critical analysis |
| △Student-student interaction | △Group investigations | ▲Cooperative controversy | △Dyadic murder script | Teacher think-alouds |
| △Pairs check | △Authentic tasks | | | |

**Figure 1: Teaching Strategies Dimensions Graph**

The definitions of the four quadrants, identified by Roman numerals, are as follows:
I. The Relative Importance is high, but the Frequency of Use is low. This suggests that the teachers value the constructivist teaching practices, however they are not utilising them when telephone teaching.
II. The Relative Importance and Frequency of use are both high. This suggests that the teachers are valuing and utilising teaching strategies that are constructivist in nature.
III. The Relative Importance and the Frequency of Use are both low.
IV. The Relative Importance is low and the Frequency of Use is high. This suggests that strategies are frequently being utilised that are not regarded as important.

### Problem-Centred Learning

Problem-centred learning was rated highly by the teachers in terms of relative importance and moderate in regard to frequency of use. This finding supports the opinion of Jonassen et al. (1995) who posit that "Constructivist learning environments should emerge from authentic tasks, engage the learners in meaningful, problem-based thinking, and require negotiation of meaning and reflection on what has been learned" (p. 21).

### Authentic Tasks

Authentic tasks were rated highly by the teachers in regard to importance (mean of 4.23), and were also rated highly in regard to frequency of use (mean of 3.82). This finding offers support to the notion by Lave and Wenger (1991) who state that an important emphasis of constructivist beliefs about learning is the need for embedding learning in real-world situations whereby learners function as part of a community of practitioners helping to solve real-world problems. While this study did not seek to establish whether learners were functioning as a part of a 'community of practitioners', the finding that the teachers were situating learning in real-life activities or authentic tasks, provides support to the existence of constructivist teaching practices occurring at the Charleville SDE.

### Student-Initiated Questioning

Figure 1 shows that student-initiated questioning received a mean of 4.23 in regard to relative importance, and a mean of 3.38 in regard to frequency of use. This result concurs with the finding by Schmidt et al. (1994) in their research in which migrant students were taught algebra by telephone, where they found that the number of student-initiated questions increased rapidly after only two days of class. Also, the length of each student interaction increased from initial short answers to more complex explanations. Similarly, a teacher at Charleville commented that the telephone enabled a 'Discussion', and 'Question and Answer Time', where the opportunity for students to interact and discuss current issues at some depth was provided. This was realised through:

- A country discovery session (Passport activities) where children provide reports on countries;
- Morning session includes World News, Poetry, Secret Sound and Music Reviews. Children look for comments about each other's sessions;
- A perusal of the Country Life newspaper. Active discussion results from the stories in the paper.

In regard to the items relating to 'student-led discussions' and 'student-initiated questioning', high means were recorded. That is, these strategies were rated by the teachers as relatively important and frequently

used. However, the following observation by one of the teachers at Charleville may emphasise a need for teachers to monitor the telephone teaching environment to ensure equity in on-air student participation.

> "As my students have spent the previous 5/6 years learning on radio they have found the transition to phone exciting, but also a little challenging. Though encouraged to interact at higher levels than they were previously able to, some still have difficulty with leading/initiating a discussion - others enjoy this aspect greatly". (Charleville Teacher, 2000)

Similarly, in Schmidt et al.'s (1994) study, although the number of student-initiated questions increased rapidly after a very short time, it was noted that initial dialogues did not involve some of the students in the telephone class. To overcome this problem, the instructor kept a record of both the number and the length of interactions for each student, and made a point of having at least five interactions with each student every day. It was found that after some initial hesitation, those students who were initially reluctant to speak on air, quickly overcame their inhibitions. The researchers attributed this, in part, to the safe environment that had been established in the telephone teaching classroom whereby students felt that they could take risks.

### Questioning

According to Wilson and Wing Jan (1994), questioning is the very cornerstone of inquiry, helping students to:

- extend their thinking skills;
- clarify understandings;
- create links between ideas;
- enhance curiosity; and
- provide challenges (p.43).

It is therefore very encouraging that the results obtained in this study showed information-seeking questions and student-initiated questions to be among the most highly rated strategies, both in terms of relative importance, and frequency of use. Additionally, of great significance was the finding that open-ended questions were not only the most highly rated among all the strategies in terms of relative importance, but also in relation to frequency of use. This result is significant in terms of constructivist teaching practices occurring at the Charleville SDE, because as stated by McKeown and Beck (1999), open-ended questions "ignite thinking" and promote discussion, and contribute to the development of a constructivist teaching and learning environment (p. 26).

### Student-led Discussion

Teachers rated student-led discussions as moderately high in terms of relative importance, and moderate in regard to frequency of use. This is a significant finding given the benefits of peer-led discussions asserted by Dymock and Hobson (1998). They emphasise that the value of peer-led discussions is that they can encourage students to value their own opinions and to explore subjects more effectively through interaction with other students, as well as help them develop learning skills they can use more broadly. While Dymock and Hobson's study focussed on adult distance education, the findings are relevant to the Charleville SDE, particularly to students at the upper primary/secondary level where student-led discussions may be more frequently utilised.

### Teaching Strategies situated within Quadrant I

The following strategies were found to be of little to moderate importance, and were rarely utilised by the teachers at the Charleville SDE:

- Collaborative Group Work/Pairs Work
- Group Investigations
- Cooperative Controversy
- Dyadic Murder Script
- Pairs Check

Due to the relative obscurity of some of these strategies (for example, Cooperative Controversy, Dyadic MURDER Script and Pairs Check), and a general absence of these strategies from educational literature, it is not surprising that the results obtained showed moderately low levels of importance and low levels of use of these strategies. However, what was surprising were the relatively low levels of use of both group investigations and collaborative group work/pairs work. This is explored in the following section.

Collaborative learning represents a significant shift from conventional approaches to teaching and learning, especially in the context of distance education (Garrison, 1997). Garrison states that educationally worthwhile knowledge is greatly enhanced within a collaborative environment, and that collaboration is suited for higher-order learning and a deep/meaningful approach to the teaching and learning process. This is supported by Oliver (1999) who posits that when students work in groups and small teams, the interactions frequently engage higher-order thinking and lead to critical reflection by the students. As the telephone is a technology which is uniquely suited to facilitating interaction and collaboration (Hardy & Olcott, 1995; Thach & Murphy, 1994), in addition to being congruent with constructivist approaches to learning (Garrison, 1997), it could be assumed that the results would have

shown collaborative group work to be a highly valued and highly utilised teaching strategy in the telephone teaching environment at the Charleville SDE.

However, as is evident in the results obtained in this study, although collaborative group work was rated by the teachers as a significantly important teaching strategy (mean of 3.77), it was not a strategy that was often utilised (mean of 2.38). Additionally, another strategy which would promote interaction among students, group investigations, although rated by the teachers as a significantly important strategy (mean of 3.77), was again, not often used (mean of 2.08).

Perkins (1999) offers an explanation which might account for these results, stating that "constructivist techniques often require more time than do traditional educational practices" (p. 8). This notion is reiterated by McKeown and Beck (1999) who state that "creating an environment in which students build their own knowledge is a much harder task than just asking questions and fielding answers" (p. 25). As Kaye (1992 cited in Garrison, 1997) suggests, collaboration is more than "simply exchanging information or passing on instructions" (p.5) and, therefore, demands the creation of a special learning environment (Garrison). Collaborative learning necessitates critical discourse for the purpose of "going beyond information exchange" (Garrison, p. 5). It is the "constructive development of connected ideas and coherent knowledge structures through group communication" (Garrison, p. 6). Recognising the relative difficulty in creating a truly collaborative environment in which collaborative group work and group investigations are more the rule than the exception, the comment by a teacher at Charleville that "with very little on-air time (20%) and students physically separated by hundreds of kilometres, there is not a lot of scope for group work", could be argued to be well justified (Charleville Teacher, 2000).

In regard to the issue of limited on-air time and the moderately low use of collaborative group work/pairs work at the Charleville SDE, I raised this issue with Randy Garrison (personal communication, 11 December, 2000), whereby I asked him how it was that a Transactional Constructivist paradigm for teaching and learning could be established given the very limited periods of on-air time in the distance education setting. He responded by commenting that "we may have an ideal but invariably when we come to design an educational experience and apply these ideals, compromises have to be made". However, Garrison then outlined a number of strategies which could be incorporated into the distance learning program in order to overcome some of these limitations, which are presented below:

- Firstly, ensure that measured learning outcomes are consistent with a constructivist approach to learning. For example, if one measures simple recall, this will undo all good efforts to promote the construction of meaning;

- Carefully plan learning activities such that considerable reflection can be achieved and issues identified before going on air. This may mean focusing on the organisation of knowledge (frameworks) and not on the details;
- Have a metacognitive view of how to progress to higher-order learning outcomes and to design activities with specific goals in mind;
- Finally, the facilitator should be somewhat 'directive' in focusing the discussion/questioning so as not to waste time. That is, use the time to question and construct and confirm meaningful frameworks (Garrison, personal communication, 11 December, 2000).

If the creation of a constructivist telephone teaching and learning environment is a desirable goal, then the benefits to be gained by including collaborative group work should be acknowledged and addressed. As emphasised by Seaton (1993), collaboration is the focus of constructivist distance learning activities. This notion is reiterated by Jonassen et al. (1995) who state that "Distance learning will be more effective when it takes place in stimulating learning environments designed on constructivist principles" (p. 22). As stated by Garrison (1993a), it is important to emphasise that students can best create and validate understanding in an interactive environment where concepts are offered, challenged, and acted upon. "Perhaps, somewhat paradoxically, the student can best take responsibility for constructing meaning in a rich collaborative environment" (p.16).

As stated, the results showed that for the more obscure teaching strategies, these were not highly valued nor frequently used. An example of this is the teaching strategy of 'cooperative controversy' which was not highly valued nor frequently utilised by the teachers at the Charleville SDE. However, according to Garrison (1993b),the type of interactive communication offered by such a strategy gives learners the opportunity to develop deep understanding. Similarly, Brown and Palincsar (1989) state that integrating, elaborating, and restructuring concepts are "more likely when one is required to explain, elaborate, or defend one's position to others, as well as to oneself" (p. 395). The teaching technique of 'cooperative controversy' with its focus on students participating in debates, may work some way towards achieving these aims.

Overall, the findings suggest that the telephone teaching and learning environment at the Charleville SDE, as measured by teachers' perceptions of the elements of teaching strategies and interaction, was substantially constructivist in nature.

## Conclusion

This paper established the research problem and central research question. This was followed by implications and limitations of the study. Directions for future research concluded the thesis.

The development of high performance communication technologies is promoting the creation of exciting and innovative pedagogies in the distance education setting. While the Charleville SDE is now utilising a technology which has many benefits for learners, the telephone remains, when used alone, a second generation technology. The significance of this for the education of rural and remote students cannot be ignored. It is imperative that in this age of rapid technological development, governments and education systems work strategically to implement the necessary changes to ensure rural and remote students do not get left behind. Access to a fair, just and equitable education is the right of *every* Australian child.

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